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BREEDING SEASON DIET OF SHORT-EARED OWLS IN MASSACHUSETTS

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ABSTRACT.—Short-eared Owl diet at Monomoy National Wildlife Refuge, Chatham, Massachusetts, was studied from 1982–1987. Pellet and carcass data yielded 3654 prey items; 2948 from the breeding season and 706 from the non-breeding season. Thirty-two prey species from four taxonomic classes were recorded. Approximately 83.0% of the breeding season diet was small mammals. Of these, 93.8% were meadow voles (*Microtus pennsylvanicus*). Mammals represented 95.0% of the non-breeding season diet, with meadow voles accounting for 97.9%. Prey per pellet averaged 1.2 and 1.0 for the breeding and non-breeding seasons, respectively. *Received 9 May 1992, accepted 24 Dec. 1992.*

Short-eared Owls (*Asio flammeus*) are one the most widespread owl species in the world (Burton 1973). Although there are numerous studies of their diet (Clark et al. 1978), there is little data from the breeding season. I know of only one published study (Clark 1975) which reported >500 prey items during the breeding season. Here, I report breeding and non-breeding season diet of Short-eared Owls over a five year period.

STUDY AREA AND METHODS

Monomoy National Wildlife Refuge is at the "elbow" of Cape Cod, Barnstable County, Chatham, Massachusetts. The refuge is part of a barrier beach ecosystem that evolved from eroding glacial deposits along outer Cape Cod (Giese 1981). At the time of study, the North Island was 0.5 km from the mainland and with the South Island, they extended linearly approximately 10.7 km south into the Atlantic Ocean.

North Island (126 ha) was approximately 2.7 km long and 0.5 km at its widest point. Various types of upland habitat covered 64 ha (Norton et al. 1984), while 62 ha were estuarine habitat (Cowardin et al. 1979, Tiner 1984). South Island (700 ha) was 8.0 km long and 2.4 km at its widest point. Upland habitat covered 604 ha, and marine habitats covered the remainder. South Island had fresh water ponds and the greater floral (Lortie et al. 1991) and faunal diversity (Holt et al. 1985, 1987a).

Field seasons covered March through September 1982–1987 with few visits in fall and winter. I defined the breeding season as March through July and non-breeding season as August through February. Short-eared Owl pellets were identified and separated from sympatric Northern Harrier (*Circus cyaneus*) pellets using techniques described by Clark (1972) and further refined by Holt et al. (1987b). Skulls and dentary remains were used to identify and quantify mammalian prey from the owl pellets. Feathers, legs, maxilla, and mandibles were used to identify and quantify avian prey from owl pellets. Bird carcasses found and suspected of owl predation were investigated using techniques described by Nisbet (1975), Nisbet and Welton (1984) and Holt (1987). Most vertebrates were identified as to species. Invertebrates were identified to the closest taxonomic level possible using field guides. I used Chi-square contingency analysis (Siegel 1956) to test for differences in proportions for Crustaceans/Insects, Birds, and Mammals, among years and seasons.

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TABLE 1

BREEDING SEASON DIET OF SHORT-EARED OWLS ON MONOMOY NATIONAL WILDLIFE REFUGE, 1982–1987

	1982	1983	1984	1985	1986	1987
Insects						
Dragonfly (Odonata)			1			
June beetle (*Phyllophaga* spp)	8	9	29	49	37	6
Subtotal	8	9	30	49	37	6
Percent total	(3.2)	(1.3)	(4.6)	(6.0)	(10.1)	(3.3)
Crustaceans						
Blue crab (*Callinectes* spp.)				1		
Crab spp.				1		
Sub-total				2		
Percent total				(tr)		
Birds						
Wilson's Storm-Petrel (*Oceanites oceanicus*)		1	1			
Leach's Storm-Petrel (*Oceanodroma leucorhoa*)	2	8	8	12	2	4
Black-bellied Plover (*Pluvialis squatarola*)			2			
Willet (juv.) (*Catoptrophorus semipalmatus*)		1				
Sanderling (*Calidris alba*)		1				
Semipalmated Sandpiper (*C. pusilla*)			1	1		
Least Sandpiper (*C. minutilla*)		1				
Laughing Gull (juv.) (*Larus atricilla*)	5	4	8			

TABLE 1
CONTINUED

	1982	1983	1984	1985	1986	1987
Common Tern (*Sterna hirundo*)						
(juv.)	43	42	22			
(adult)	29	8	10			
Short-eared Owl (*Asio flammeus*)		2	3			
Great Crested Flycatcher (*Myiarchus crinitus*)		1				
Horned Lark (*Eremophila alpestris*)				1		
Black-capped Chickadee (*Parus atricapillus*)			1			
Gray Catbird (*Dumetella carolinensis*)			6			
Solitary Vireo (*Vireo solitarius*)			1			
Yellow-rumped Warbler (*Dendroica coronata*)			1			
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)			1			
Rufous-sided Towhee (*Pipilo erythrophthalmus*)			3			
Red-winged Blackbird (*Agelaius phoeniceus*)			2			
Passerine spp.	4	28	21	46	5	8
Sub-total	83	98	94	60	7	12
Percent total	(33.6)	(14.6)	(14.2)	(7.4)	(1.9)	(6.6)
Mammals						
Masked shrew (*Sorex cinereus*)			1	1		
Northern short-tailed shrew (*Blarina brevicauda*)		1				

TABLE 1
CONTINUED

		1982	1983	1984	1985	1986	1987
Shrew spp. (*Sorex* spp.)					3	1	
Big brown bat (*Eptesicus fuscus*)			1				
White-footed mouse (*Peromyscus leucopus*)			25	16	36	23	6
Meadow vole (*Microtus pennsylvanicus*)		156	524	520	650	294	157
Muskrat (juv.) (*Ondatra zibethica*)						2	
Norway rat (juv.) (*Rattus norvegicus*)						3	
Meadow jumping mouse (*Zapus hudsonius*)			11	8	12	1	1
Sub-total		156	562	545	702	324	164
Percent total		(63.2)	(84.1)	(81.2)	(86.3)	(88.0)	(90.1)
Grand Total		247	669	669	813	368	182
Percent total 1982–1987							
Insects	4.7%						
Crustaceans	<1.0%						
Birds	12.0%						
Mammals	83.2%						

RESULTS

I collected 3243 Short-eared Owl pellets (2539 breeding season and 704 non-breeding season pellets). Pellets were collected at favored roost sites and scattered locations on the islands. I also recovered carcasses of 141 birds killed by the owls. Pooled pellet and carcass data yielded 3654 prey items; 2948 from the breeding and 706 the non-breeding seasons (Tables 1 and 2). Thirty-two prey species were recorded from four taxonomic classes; Insecta, Crustacea, Aves, and Mammalia. All scientific names are in Tables 1 and 2. This is the largest sample of breeding season diet for Nearctic Short-eared Owls yet reported.

There were highly significant differences in proportions of prey eaten during the breeding season ($\chi^2 = 211.5$, df = 10, $P < 0.001$). Approximately 83.0% of the breeding season diet was mammals, of which about 93.8% were meadow voles (Table 1). Birds represented 12.0% of the prey, dominated by Common Terns and passerines (Table 1). Insects and crustaceans were numerically insignificant in the diet. Insect remains were found in pellets from pre-fledged but dispersed young owls (see Holt et al. 1992). Prey per pellet averaged 1.2. Uncommon prey included Leach's Storm-Petrels (see Holt 1987), Common Terns, big brown bat, crabs, and nestling Short-eared Owls (Table 1).

Far fewer prey species were eaten during the non-breeding season. The proportions, however, were significantly different ($\chi^2 = 15.3$, df = 4, $P < 0.005$). Mammals represented 95.0% of the diet, of which meadow voles accounted for 97.9% (Table 2). Prey per pellet averaged 1.0.

Clearly, mammals were the dominant prey, and one mammal in particular, the meadow vole, was most frequently eaten. Terns were eaten during three breeding seasons but then disappeared from the owls' diet. This was an artifact of the terns relocating colony sites (D. Holt, unpubl. data).

DISCUSSION

Fisher (1893) reported one of the first samples of Short-eared Owl diet. He analyzed 110 stomachs from Short-eared Owls collected at various times of the year and concluded this owl was a small mammal specialist. Since that time, Short-eared Owl diet studies have been biased for the winter season (Clark et al. 1978). Clark (1975) believed this bias was due to difficulty of locating scattered roosts and pellets throughout the owl's breeding territory. He also felt that nest sanitation by female owls reduced the number of pellets found there. In this study, I was able to locate consistently used Short-eared Owl roosts during the breeding and non-breeding seasons.

I could locate only three published quantitative accounts of Short-eared

TABLE 2
NON-BREEDING SEASON DIET OF SHORT-EARED OWLS ON MONOMOY NATIONAL WILDLIFE REFUGE, 1983–1987[a]

	1983	1984	1985	1986	1987
Birds					
Semipalmated Sandpiper		1			
Black-bellied Plover		1			
Rufous-sided Towhee	3				
Dark-eyed Junco (*Junco hyemalis*)	1				
Unidentified passerines	18	4	4		3
Sub-total	22	6	4	0	3
Percent total	(8.4)	(2.4)	(8.9)		(3.5)
Mammals					
White-footed mouse	2	3	5		
Meadow vole	237	241	36	61	82
Meadow jumping mouse		4			
Sub-total	239	248	41	61	82
Percent total	(91.6)	(97.6)	(91.1)	(100.0)	(96.5)
Grand total	261	254	45	61	85
Percent total 1983–1987					
Birds 5.0%					
Mammals 95.0%					

[a] Based on 706 prey items. Prey is from pellet contents and preyed upon avian carcasses.

Owl breeding season diet for the Nearctic. Errington (1937) reported 94.4% (N = 72) small mammals from Short-eared Owl diet in Iowa. Clark (1975) reported >90.0% (N = 524) small mammals in the Short-eared Owl diet during two breeding seasons in Manitoba, Canada. Within these two seasons, meadow voles constituted 89.0% and 100.0% of the prey, respectively. Wiebe (1991) reported >91.0% (N = 113) small mammals from British Columbia, of which 83.2% were voles (*Microtus*). Prey per pellet reported here was similar to that reported by Holt et al. (1987b). Breeding season diet data is similar for Europe and is best summarized by Mikkola (1983) and Cramp (1985). Additional information is still needed to assess the breeding and non-breeding season trophic niche of Nearctic Short-eared Owls.

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